

## Avoiding the elective complications

What is a "safe" HgbA1c in the elective case?

John G. Anderson, M.D.  
Orthopaedic Associates of Michigan  
Clinical Professor  
Michigan State University  
College of Human Medicine and  
College of Osteopathic Medicine



Co-Director, Grand Rapids Foot and Ankle Fellowship

1

---

---

---

---

---

---

---

---

## Diabetes

- 29 million Americans
- 9% of population
- 80,000 amputations per year
  - 1/3 bilateral within 3 years
- 10% have neuropathy at diagnosis
  - 50% within 25 years
- 12% will get foot ulcers
  - 85% of amputations
- Foot disorders leading cause of hospitalization



2

---

---

---

---

---

---

---

---

## Team goal

- Save lives from infection and gangrene
- Save feet and improve function
  - Deformity correction
  - Realignment fusions
  - Exostectomies



3

---

---

---

---

---

---

---

---

## Diabetes

- Multiple studies show increased risk of postop infection



4

---

---

---

---

---

---

---

---

## HgbA1c

- Represents glycemic control over 3 months
- 50% of number is result of last month
- 50% of number is result of previous 2 months
  
- Executive summary: Standards of medical care in diabetes-2014. Diabetes Care 2014;37(Suppl 1):S5-13.

5

---

---

---

---

---

---

---

---

Sugimoto H, Shikata K, Wada J. Advanced glycation end products- cytokine-nitric oxide sequence pathway in the development of diabetic nephropathy: aminoguanidine ameliorates the overexpression of tumour necrosis factor-and inducible nitric oxide synthase in diabetic rat glomeruli. Diabetologia 1999;42:878.

- Prolonged malglycemia
- Advanced Glycation Endproducts (AGEs) deposit into the soft tissues, vasculature, and bone
- Reduces Nitric Oxide (vasodilator)
- Dysfunctional vasodilatory response impairs local wound healing

6

---

---

---

---

---

---

---

---

## Additional factors

- perioperative glycemic control
- operative time
- indication for surgery
- antibiotic application
- tourniquet use
- soft tissue management
- operative technique

**Isolating a homogenous population to compare is a challenge**

7

---

---

---

---

---

---

---

---

---

---

American Diabetes Association. Standards of medical care in diabetes—2016. *J Clin Appl Res Educ.* 2016;39(suppl 1):S1-S112.

- Avoid surgery if possible if HgA1c >7

8

---

---

---

---

---

---

---

---

---

---

YOUNGER AS, AWWAD MA, KALLA TP, ET AL: Risk factors for failure of transmetatarsal amputation in diabetic patients: a cohort study. *Foot Ankle Int* 30: 1177, 2009.

- HbA1c was an important determinant of the healing rate after a transmetatarsal amputation.
- HbA1c level of 10 was a threshold above which healing was poor

9

---

---

---

---

---

---

---

---

---

---

MYERS TG, LOWERY NJ, FRYKBERG RG, ET AL: Ankle and hindfoot fusions: comparison of outcomes in patients with and without diabetes. *Foot Ankle Int* 33: 20, 2012.

- ankle and hindfoot fusions
- patients with diabetes and an HbA1c level > 7
- statistically higher postoperative infection rate

10

---

---

---

---

---

---

---

---

Jupiter DC, Humphers JM, Shibuya N. Trends in postoperative infection rates and their relationship to glycosylated hemoglobin levels in diabetic patients undergoing foot and ankle surgery. *J Foot Ankle Surg.* 2014;53(3):307-311.

- 322 patients
- 28.8% SSI
- HgbA1c 7.35
- Extreme variability in types of procedures

11

---

---

---

---

---

---

---

---

Wukich DK, Crim BE, Frykberg RG, Rosario BL. Neuropathy and poorly controlled diabetes increase the rate of surgical site infection after foot and ankle surgery. *J Bone Joint Surg Am.* 2014;96(10):832-839.

- 2060 patients
  - 323 with DM
  - 3.1% SSI
  - HgbA1c > 8 was 2.5x more likely to get SSI
  - Small sample size

12

---

---

---

---

---

---

---

---

Coan KE, Andrew B. Schlinkert, Brandon R. Beck, Danielle J, et al. Perioperative management of patients with diabetes undergoing ambulatory elective surgery, J Diabetes Sci Technol 2013;7: 983-9.

- HgbA1c of 8.0 or greater is associated with poor surgical outcomes
- A significant increase in the rate or likelihood of complications occurs when the HbA1c range is 7.0 to 8.0 or greater.

13

---

---

---

---

---

---

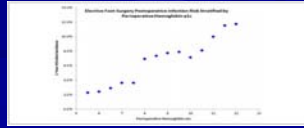
---

---

#### Hemoglobin A1c as a Predictor

of Postoperative Infection Following Elective Forefoot Surgery  
Jourdan M. Cancienne, MD1, Minton T. Cooper, MD1, Kevin A. Laroche, MD1, Dirk W. Verheul, BS1, and Brian C. Werner, MD1  
2017 FAI

- 4630 patients w/ elective forefoot surgery and preop lab
  - Pearldiver database (Humana)
- SSI ranged from 2.3-11.8% (w/i 1 year of index)
- HgbA1c >7.5 mg/dl increased risk of SSI
  - 2.8% vs 6.5% p<0001.



14

---

---

---

---

---

---

---

---

#### The Impact of Glycosylated Hemoglobin and Diabetes Mellitus on Wound-Healing Complications and Infection After Foot and Ankle Surgery

Jon M. Humphers, DPM\* Naohiro Shibuya, DPM, MS\*† Benjamin L. Fluhman, DPM\* Daniel Jupiter, PhD\*†

- HbA1c level and having at least one comorbidity were associated with postoperative infections (Obesity, neuropathy, smoking)
- Significant factors for developing postoperative wound complications were having at least one comorbidity (odds ratio, 2.03; 95% CI, 1.22–3.37) and HbA1c level (each 1% increment) (odds ratio, 1.25; 95% CI, 1.02–1.53).
- After adjusting for other covariates, the only significant factor was HbA1c level, with each increment of 1% increasing the odds of infection by a factor of 1.59 (95% confidence interval [CI], 1.28– 1.99)

15

---

---

---

---

---

---

---

---

Domek N, Dux K, Pinzur M, Weaver F, Rogers T. Association between hemoglobin A1c and surgical morbidity in elective foot and ankle surgery. J Foot Ankle Surg 2016;55:939-43.

- Large VA database (21854 patients)
- Number of comorbid conditions is strongest predictor of developing a complications, followed by the presence of peripheral neuropathy and poor HbA1c
- Suggests that glycemic control alone is not sufficient to predict their risk.

16

---

---

---

---

---

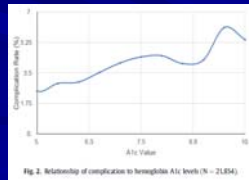
---

---

---

Domek N, Dux K, Pinzur M, Weaver F, Rogers T. Association between hemoglobin A1c and surgical morbidity in elective foot and ankle surgery. J Foot Ankle Surg 2016;55:939-43.

– for each 1% increase in hemoglobin A1c, the odds of developing a complication increased by 5%.



17

---

---

---

---

---

---

---

---

## Summary

- Current literature provides guidelines but not answers
- Multitude of factors to consider
  - HgbA1c is one of many
  - Comorbidities
  - Scope of surgery
  - Urgency/timeline
  - Ability to optimize comorbidities

18

---

---

---

---

---

---

---

---